Smart Farming for Europe: Value Creation through Precision Livestock Farming

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Overview

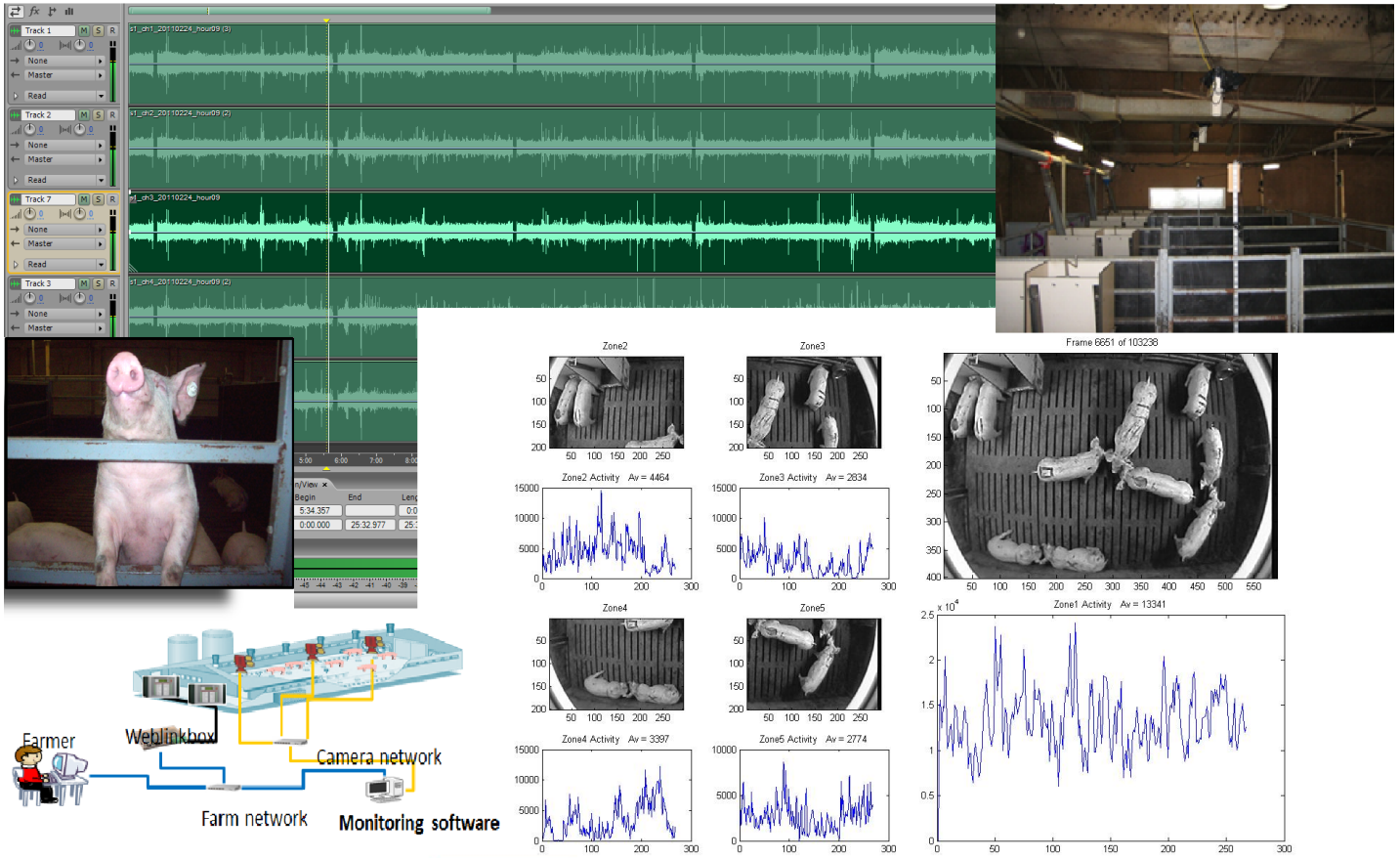
- What is Precision Livestock Farming (PLF)?
- Examples to create **VALUE**
- Conclusions

Thank to the M3-BIORES team and our partners

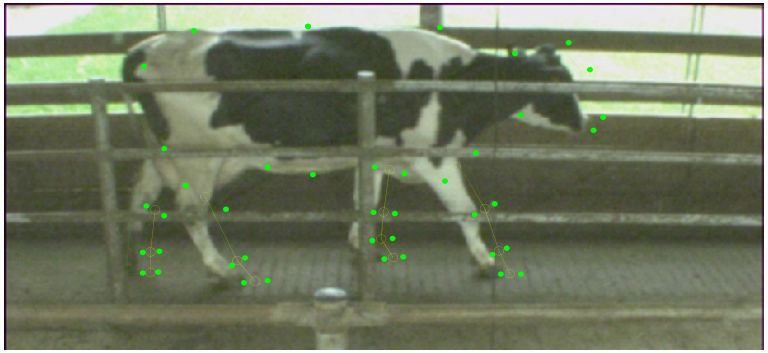
What is Precision Livestock Farming (PLF)?

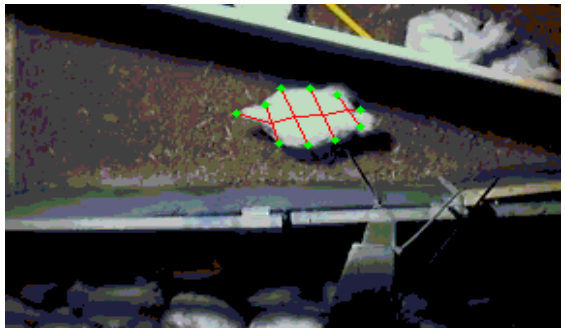
Today…Automated Systems

Technology can help to quantitatively measure **behaviour, health and performance** of animals.



What is Precision Lifestock Farming?



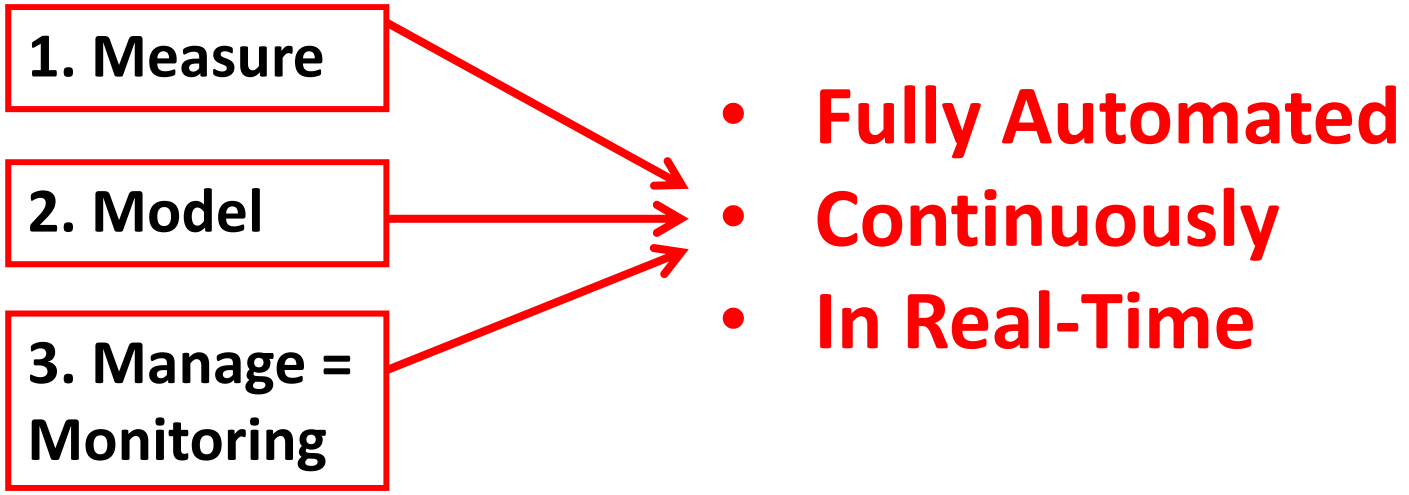


" Management of livestock farming by continuous automated real-time monitoring/controlling of production/reproduction, health and welfare of livestock and environmental impact."

A living organism:

Complex **Individual** **Time-Varying** **Dynamic**

Living organism = CITD - system



Examples of PLF Technology: What is possible today?

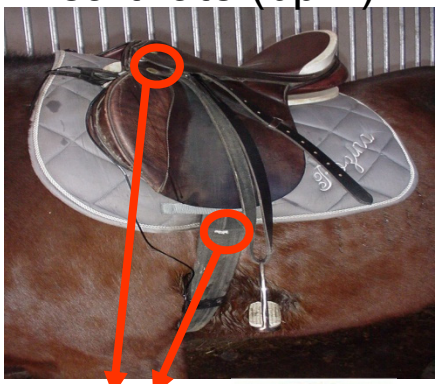
Fully automated monitoring

Several sensing techniques can be used

Image

Sensors

Heart rate (bpm)



Heart rate monitor
(Polar S610i)

Sound

Example 1:

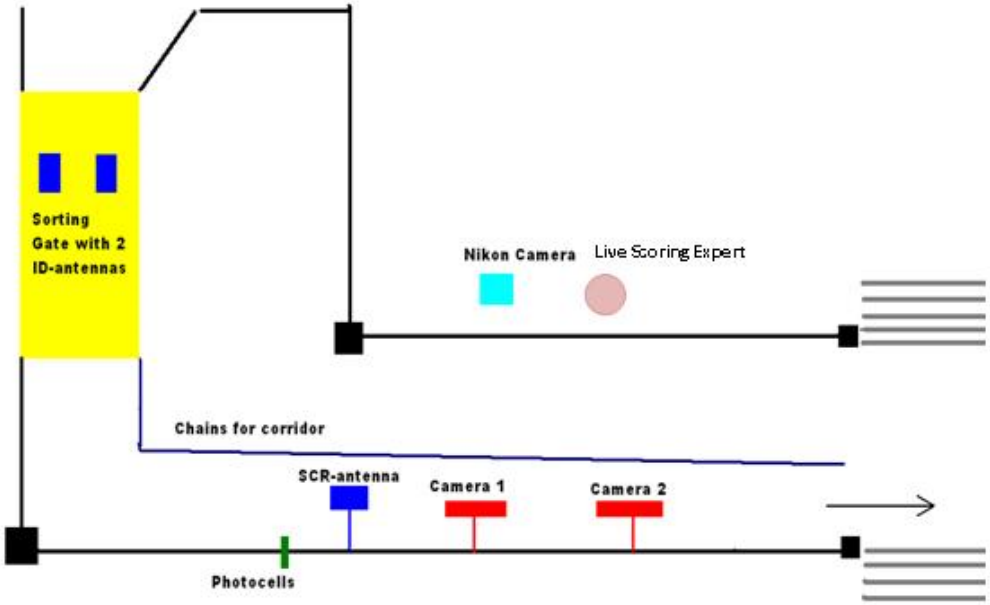
Lameness Monitor for cows

i.c.w. Wageningen, The Netherlands

VoLcani Research Institute, Israel

De Laval, Sweden

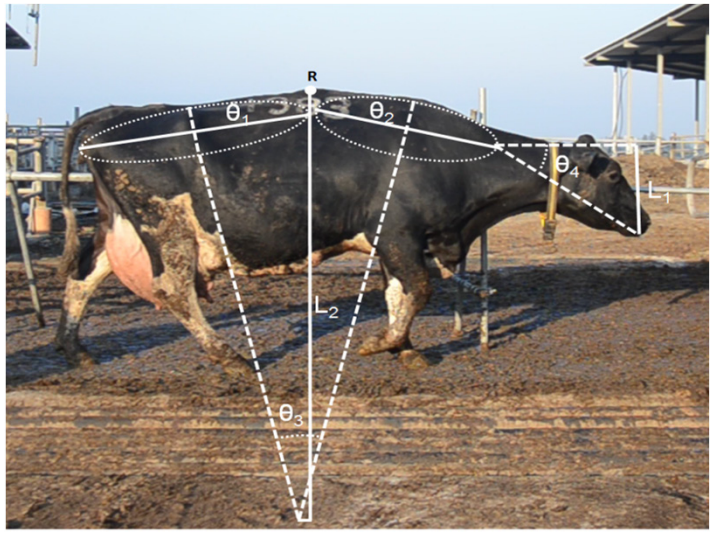
Individual lameness detection of cows
Experimental setup

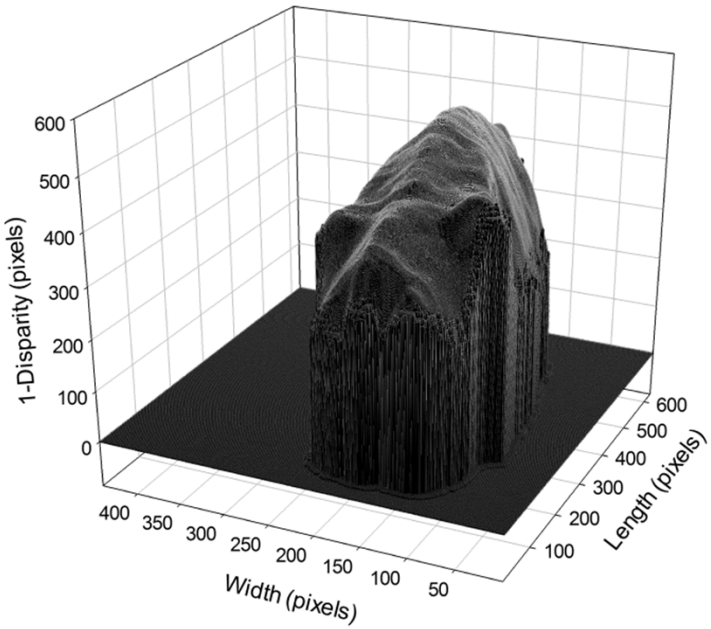


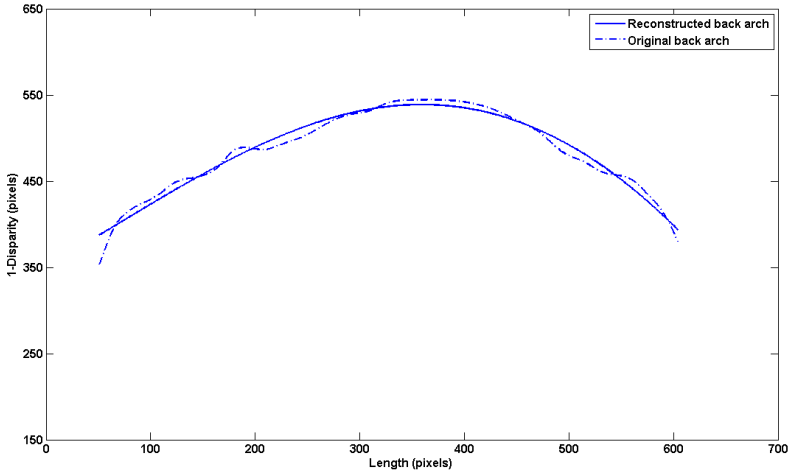
- Farm with 1000 cows
- Camera 25 fps
- Resolution: 1920 x 1080 pixels
- 90 cows recorded for 2 months
- 8 cows had lameness evolution

Results: Active Appearance Model

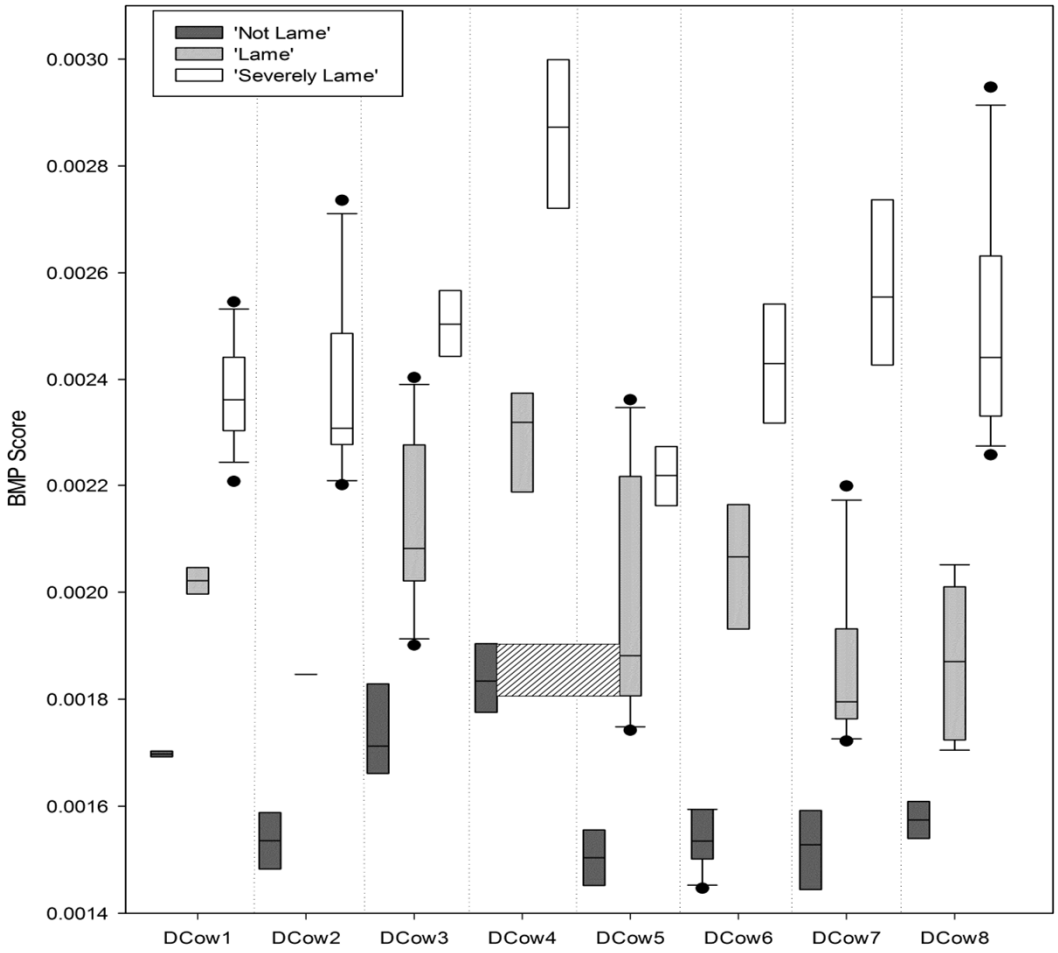
Back posture







Results

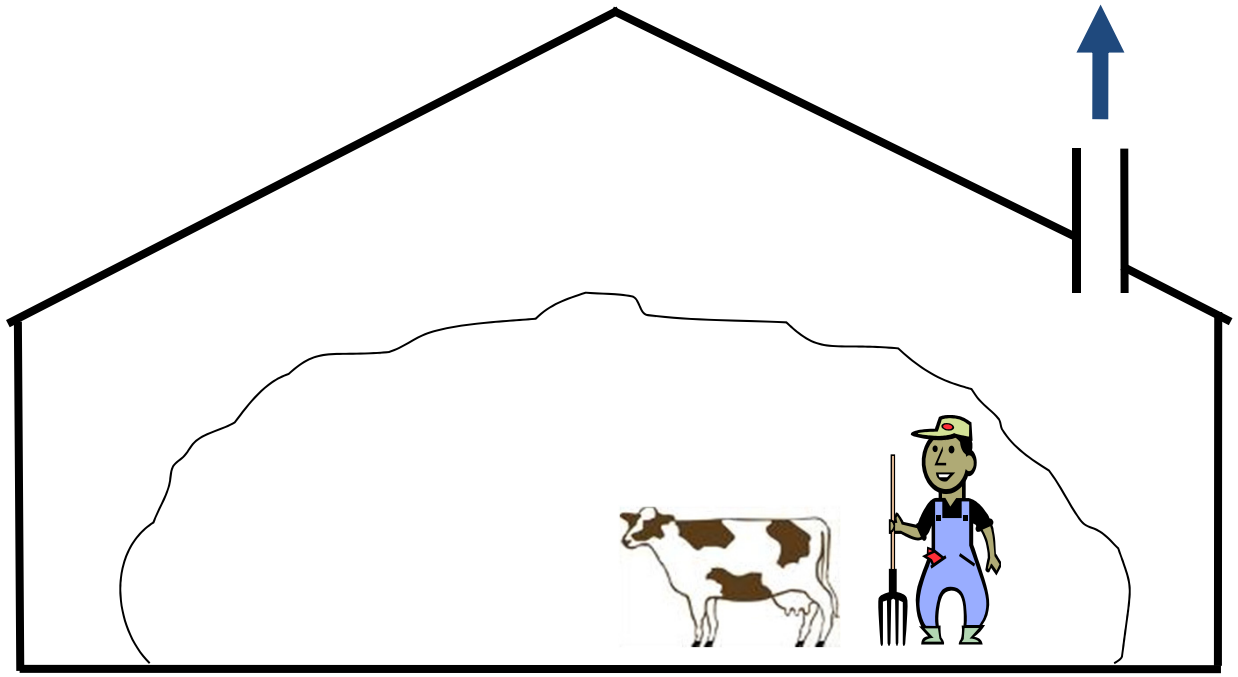


Cow	True Positive Rate	False Positive Rate	Accuracy
1	0.93	0.01	0.93
2	0.89	0.22	0.89
3	0.86	0.11	0.86
4	0.91	0.05	0.91
5	1.00	0	1.0
6	1.00	0	1.0
7	0.86	0.08	0.86
8	0.88	0.05	0.88
Total	0.91	0.06	0.91

Dataset	True Positive Rate	False Positive Rate	Accuracy
Group	0.80	0.12	0.80
Individual	0.91	0.06	0.91

Individual threshold can increase the sensitivity with more than 10%

Value:



Euros

Welfare

Health

Example 2:

On-line Pig Sound Analysis

i.c.w. UMIL, Italy

SoundTalks, Belgium

Fancom, The Netherlands

On-line Pig Sound Analysis

Pig cough monitor into a Commercial product

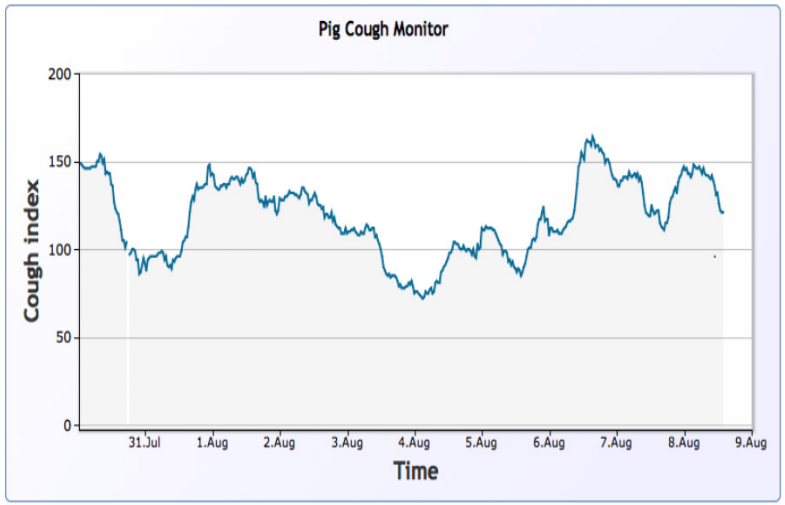
Pig Cough Monitor

Welcome Mr. John Brown

Log out

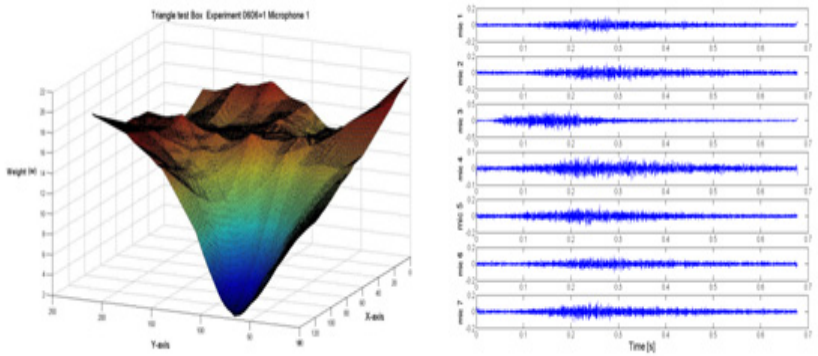
> House 1 > Compartment 11

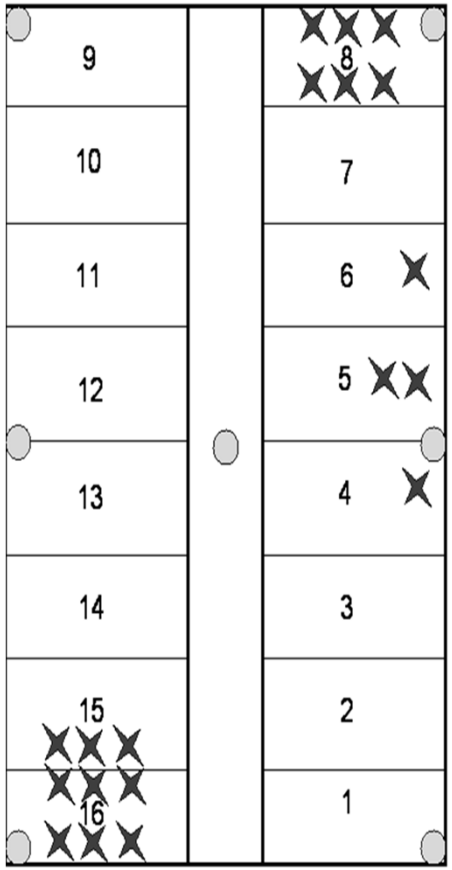
Compartment 11	Day -9	Day -8	Day -7	Day -6	Day -5	Day -4	Day -3	Day -2	Day -1	Day 0
Trend	↓	↓	↑	→	↓	↑	↑	↑	↓	↓
Trend (%)	-13%	-15%	+115%	-8%	-17%	+25%	+207%	+24%	-30%	-11%
Coughs per 24h	78	66	142	131	109	136	417	518	361	321
Coughs until 16h34	56	50	100	97	82	108	320	401	275	241
Status										



Localize cough sounds and follow the infection front in a house

Using several microphones in a stable, the location of the cough sounds can be determined



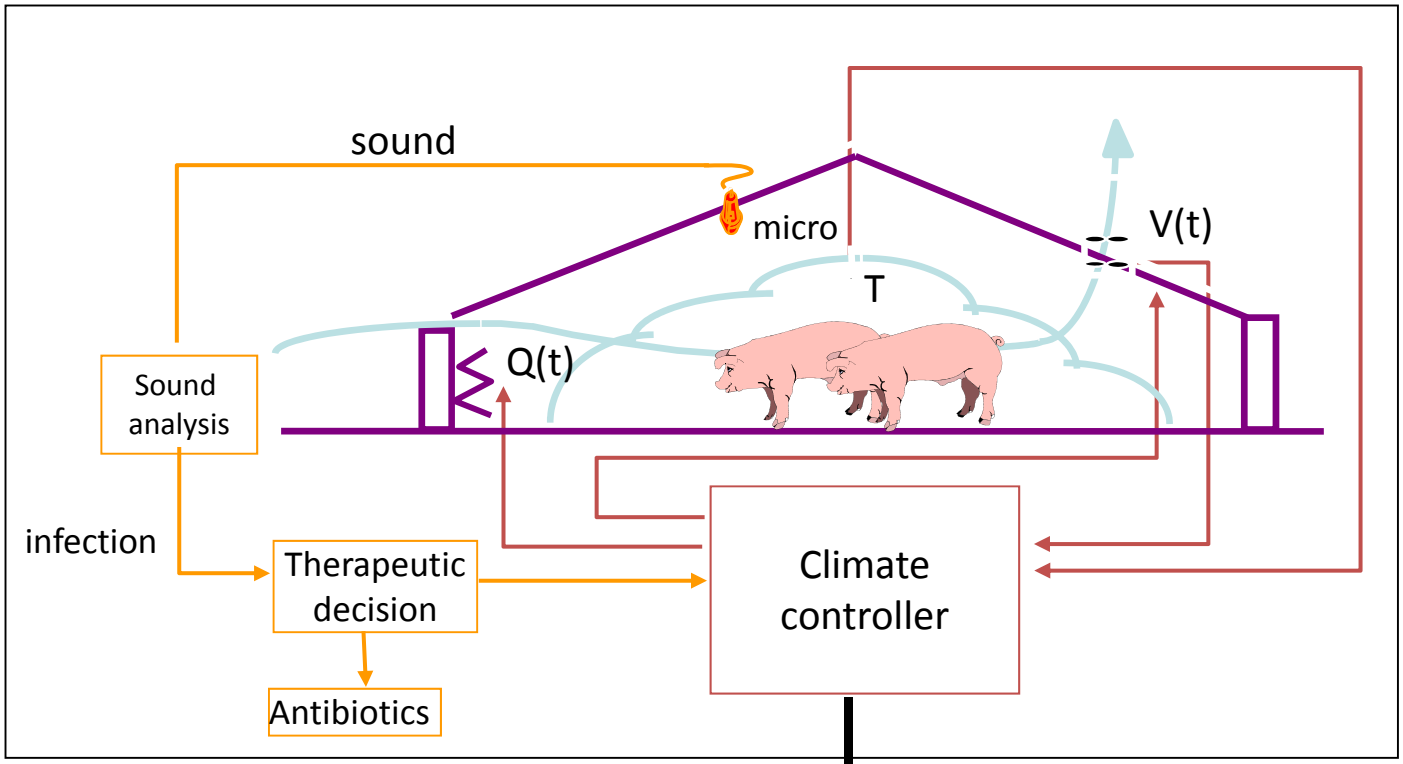


Microphone

Detected Cough

- M. Silva, S. Ferrari, A. Costa, J.-M. Aerts, M. Guarino, D. Berckmans, Cough localisation for the detection of respiratory disease in pig house. Computers and Electronics in agriculture, 64:286-292.

Main future application: Reducing the use of Antibiotics



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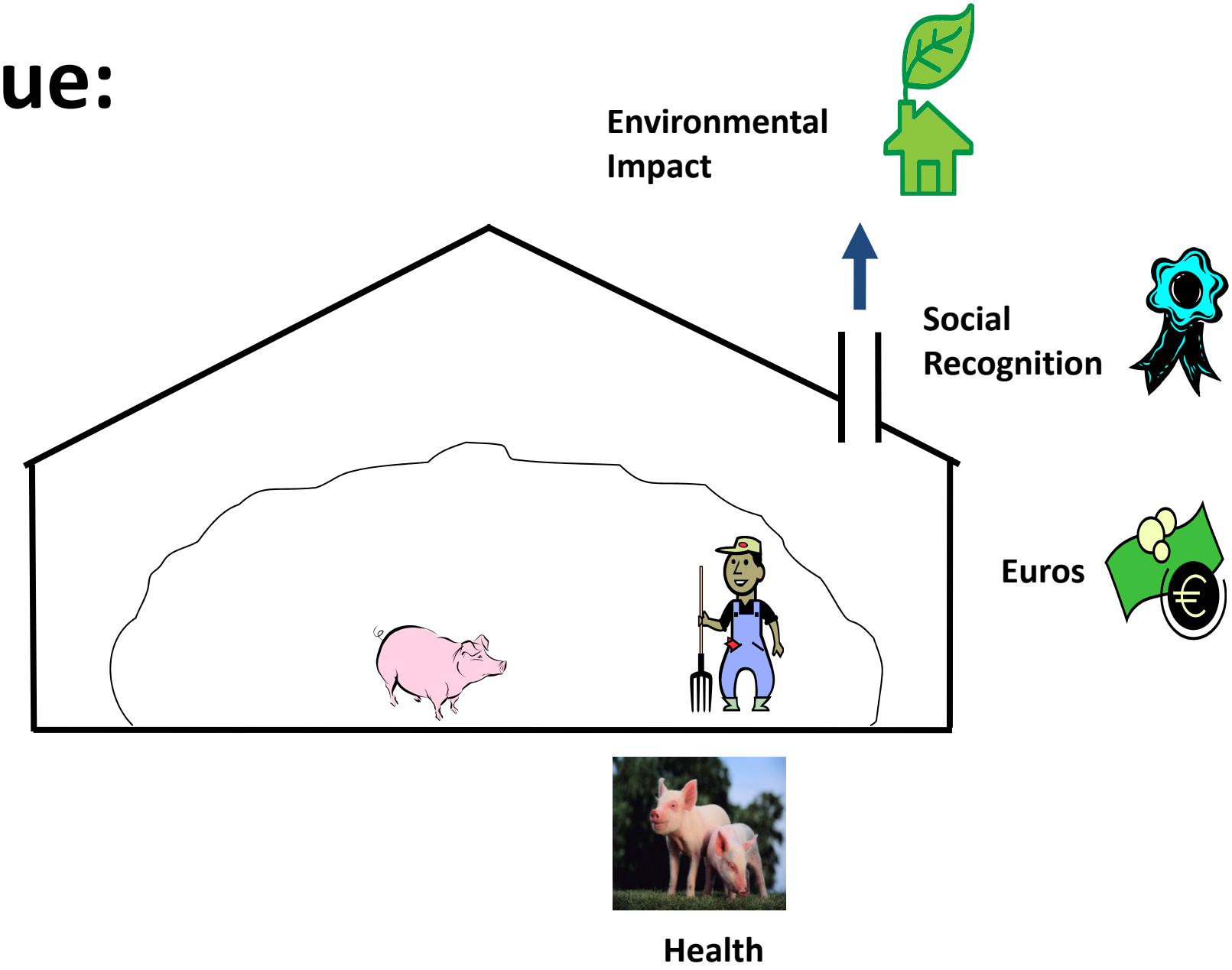


Example 3:

Monitoring of pigs'drinking behaviour

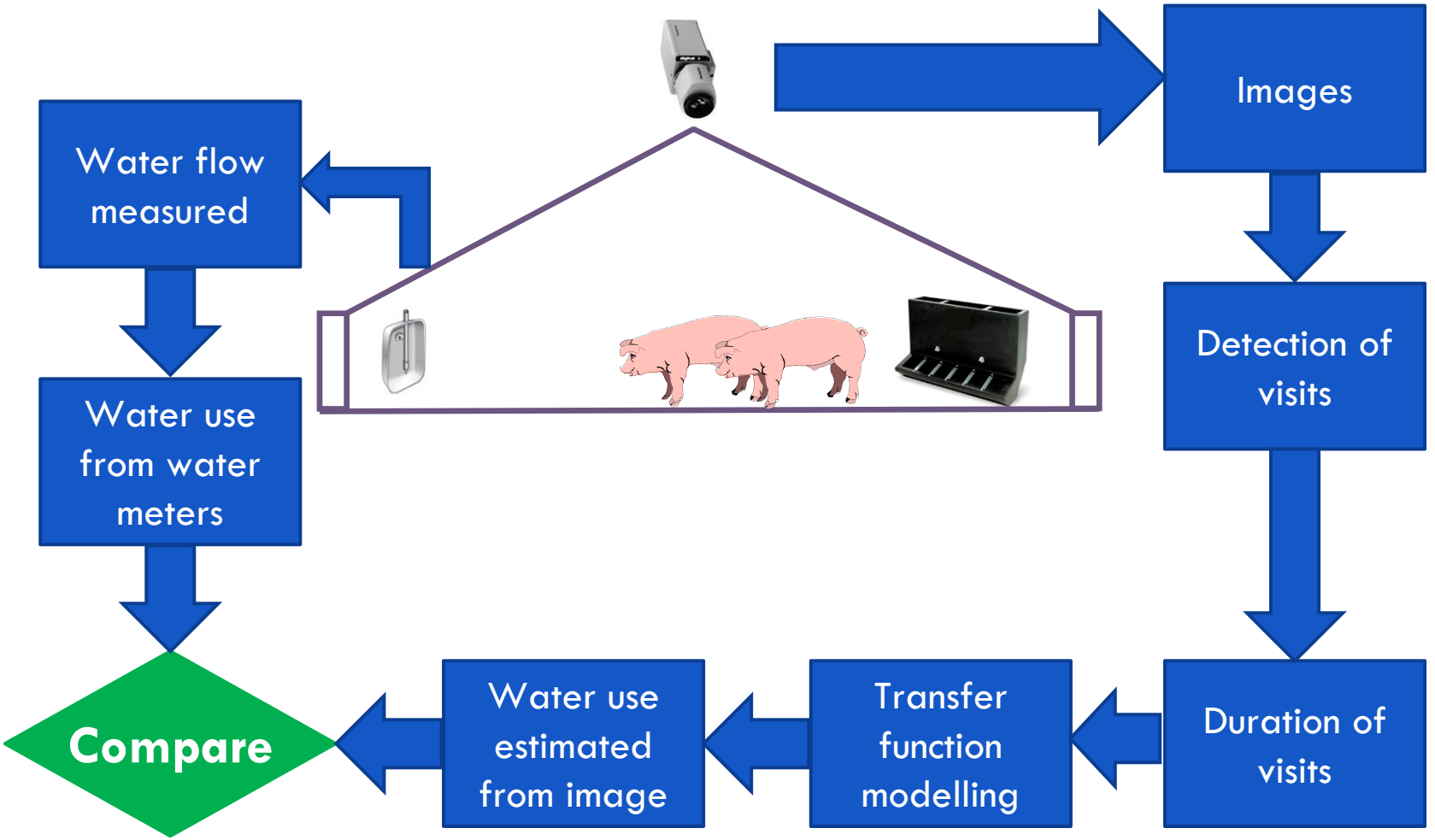
i.c.w. Ughent, Belgium

Monitoring of pigs' drinking behaviour

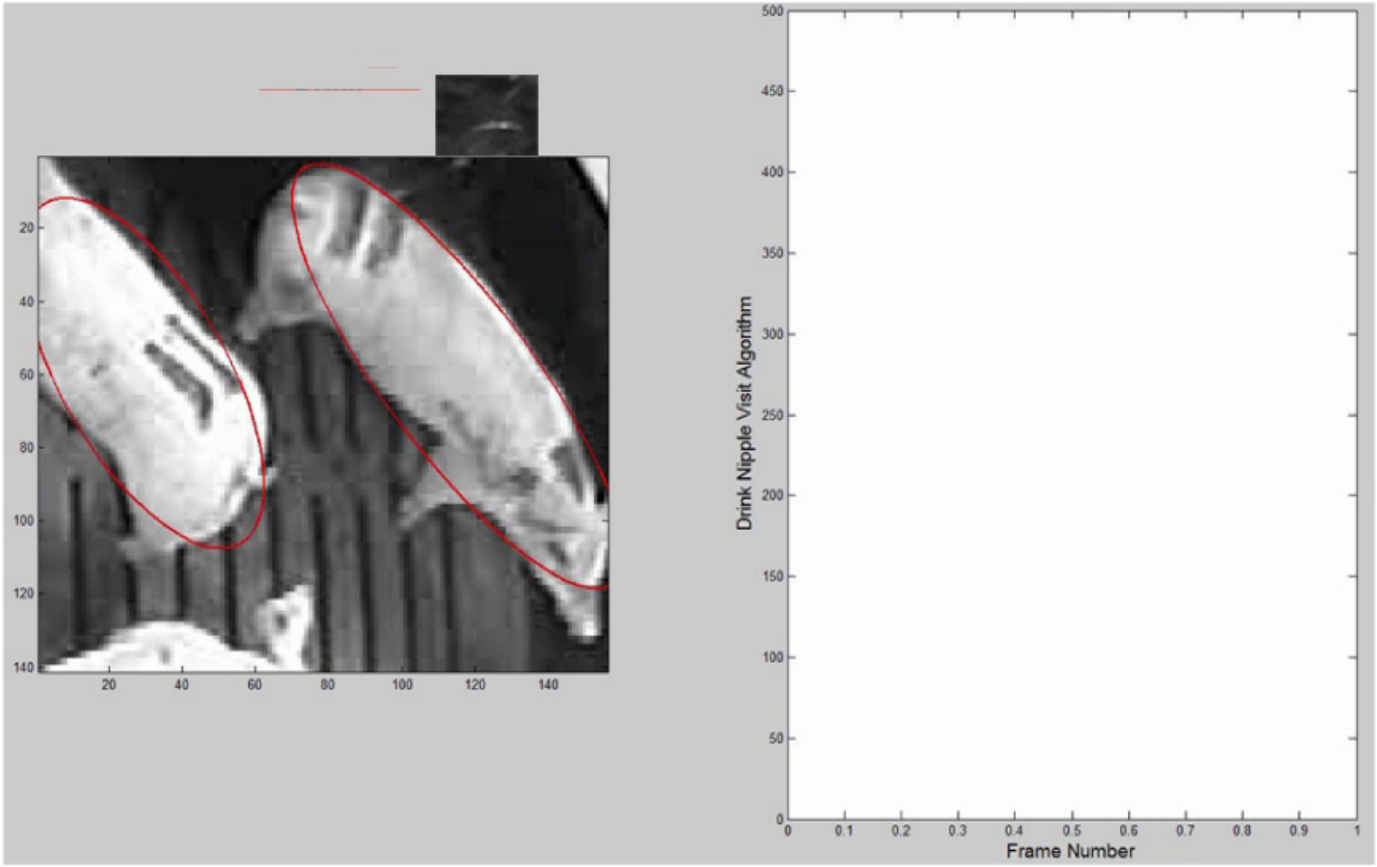
- Monitoring duration of visits to the drink nipple in a pig pen

- Estimate hourly water use by real-time analyses of drink nipple visits

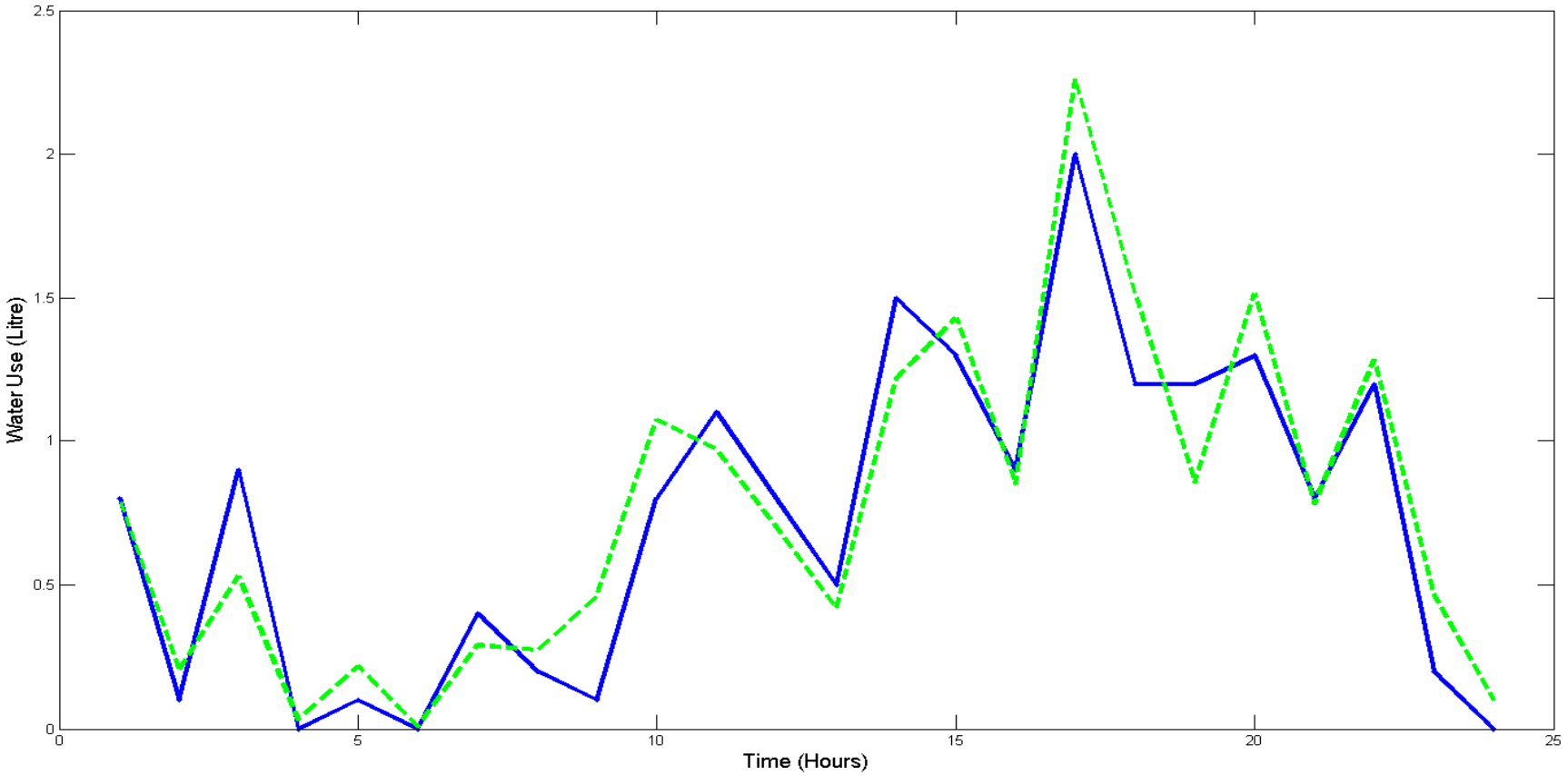
Model-based monitoring of water use



Model-based detection of visits

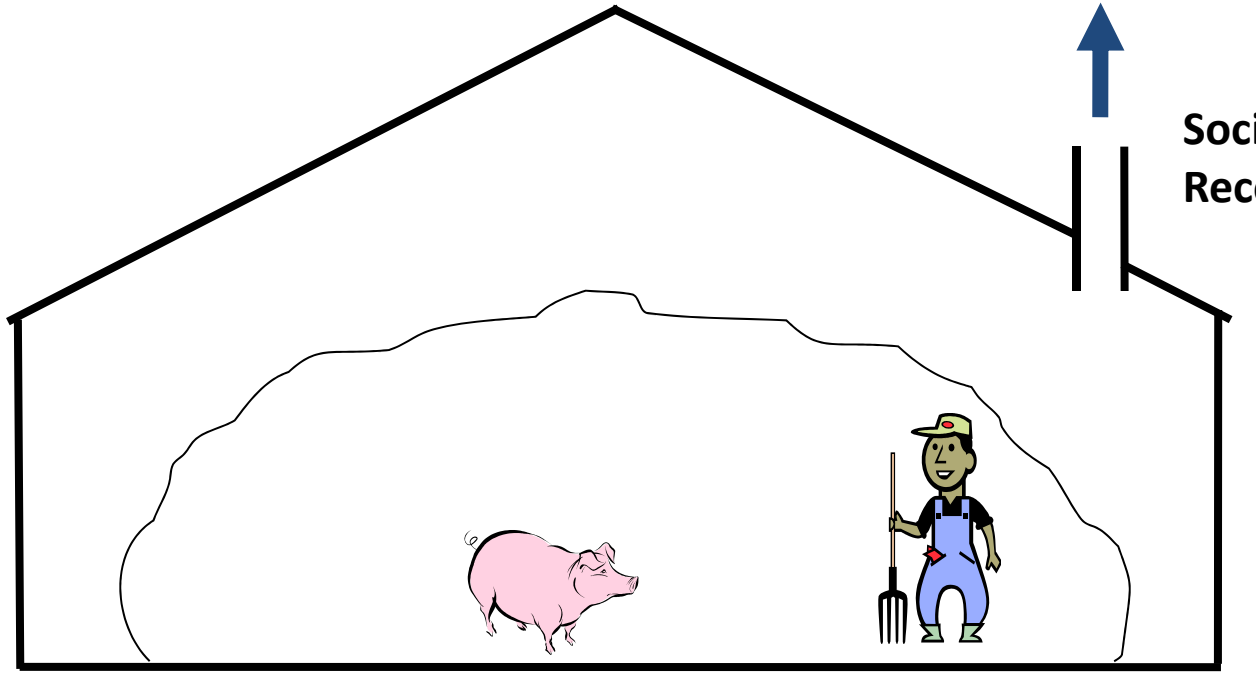


Results



Hourly water use can be estimated with an accuracy of 92% or 200 ml over 13 days

Value:



Social Recognition

Euros

Consumer

Health

Labour and Time

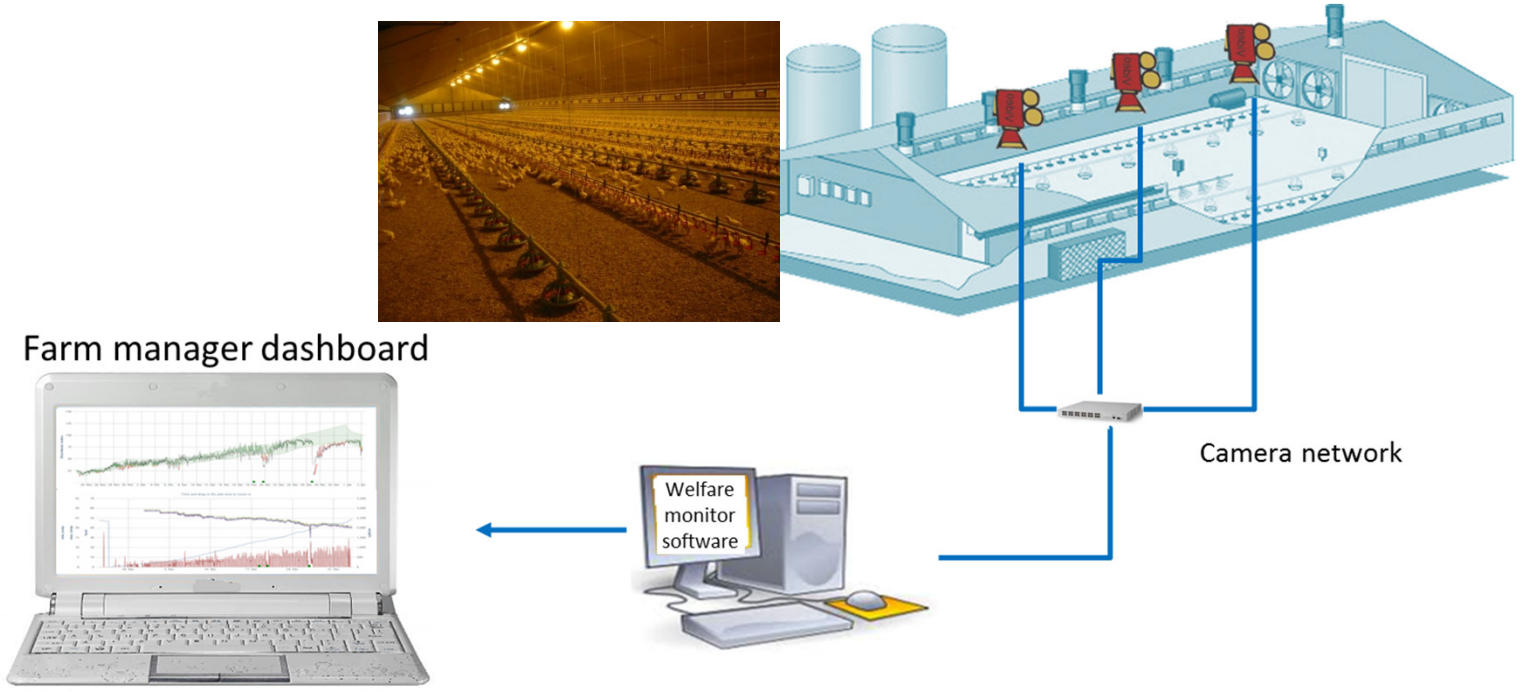
Example 4:

Early Warning System for Broiler Houses

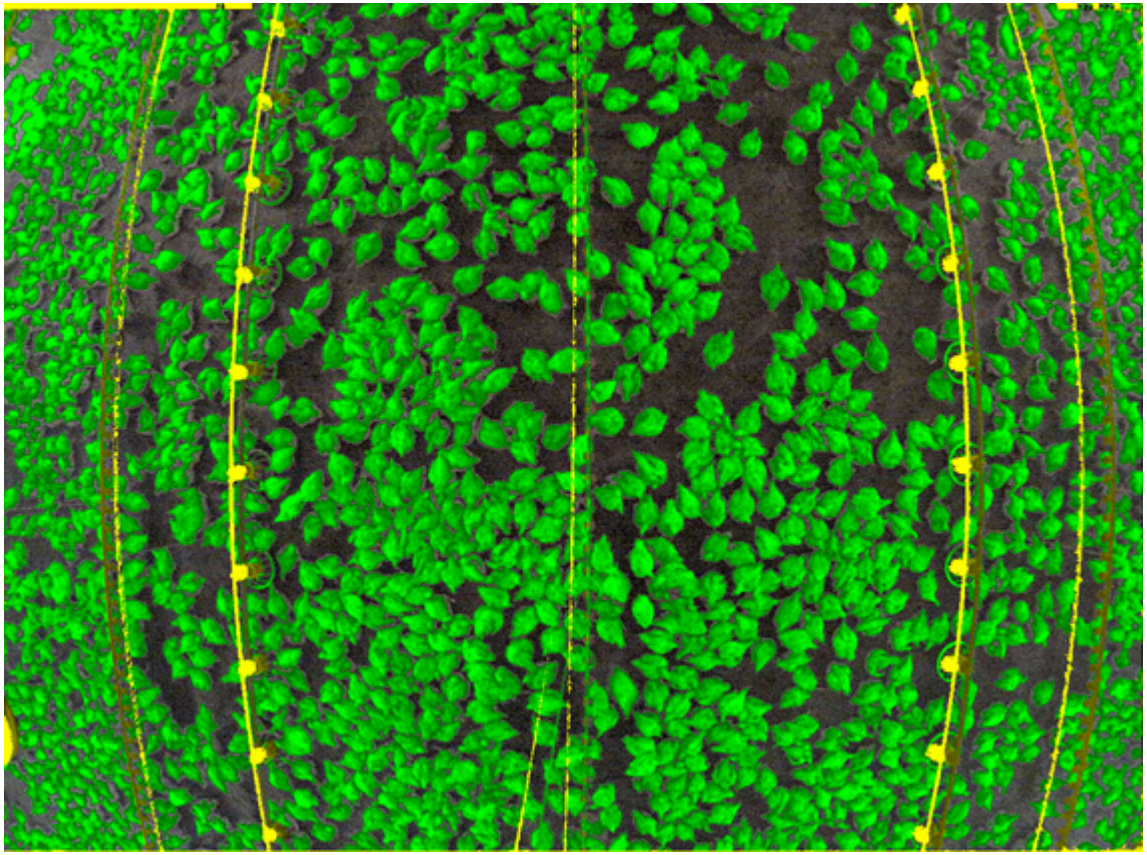
i.c.w. Fancom, The Netherlands

Vision-based Early Warning System for Broiler Houses

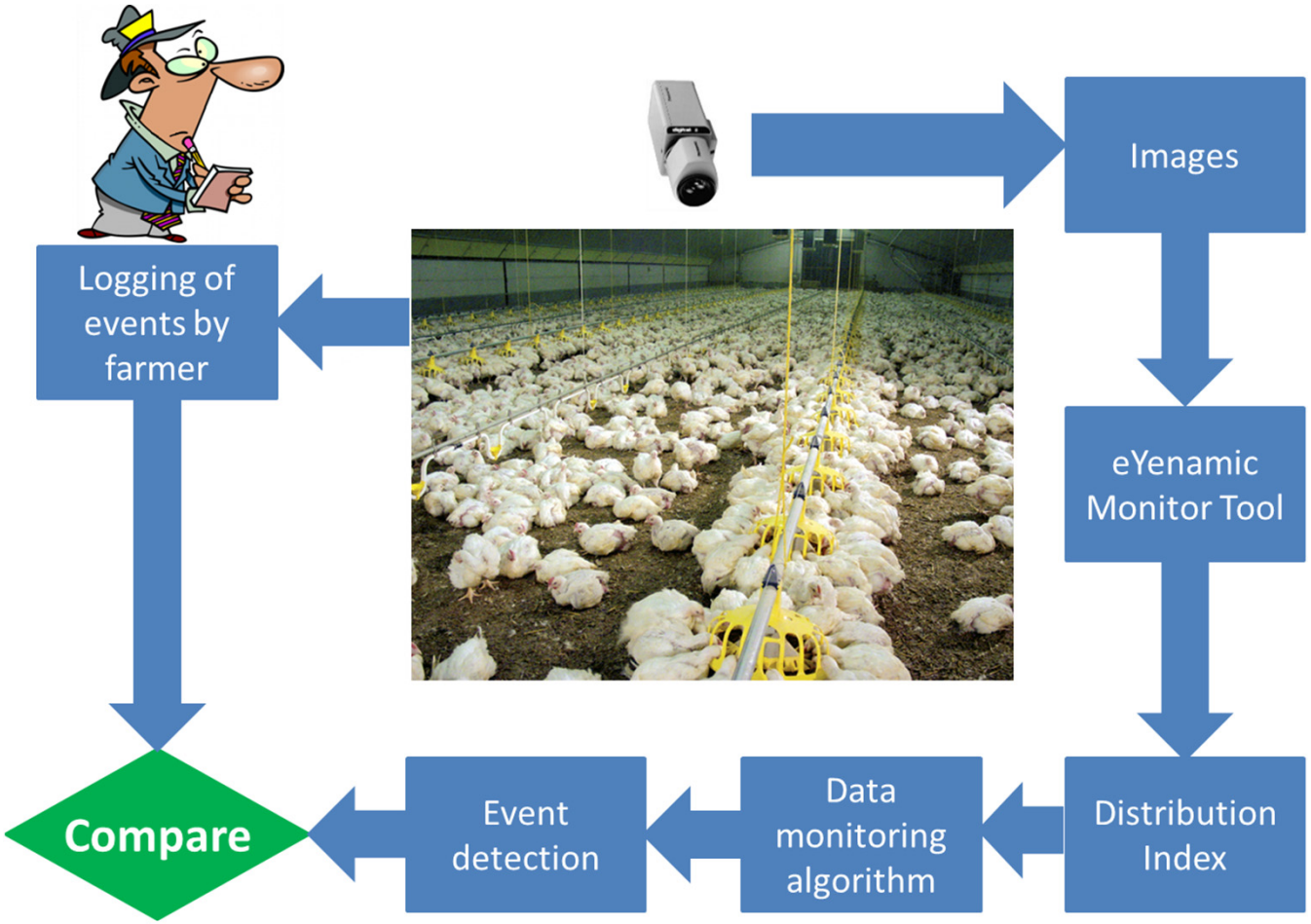
- Solution?
- Farmers can use automatic tools to continuously monitor the welfare and health of their broilers



- Detecting malfunctioning in broiler houses
- Produce alarms in real-time when malfunctioning happens (in feeder or drinker lines, light, climate control, etc.)

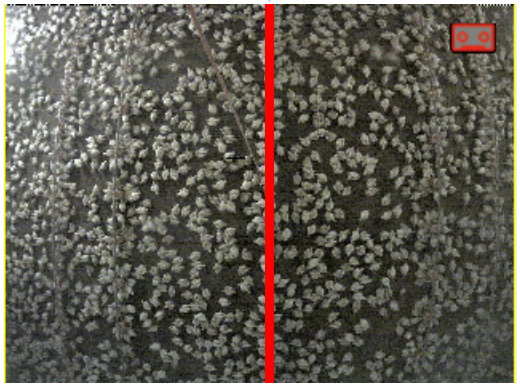


Farmer logbook and manual video observation as references



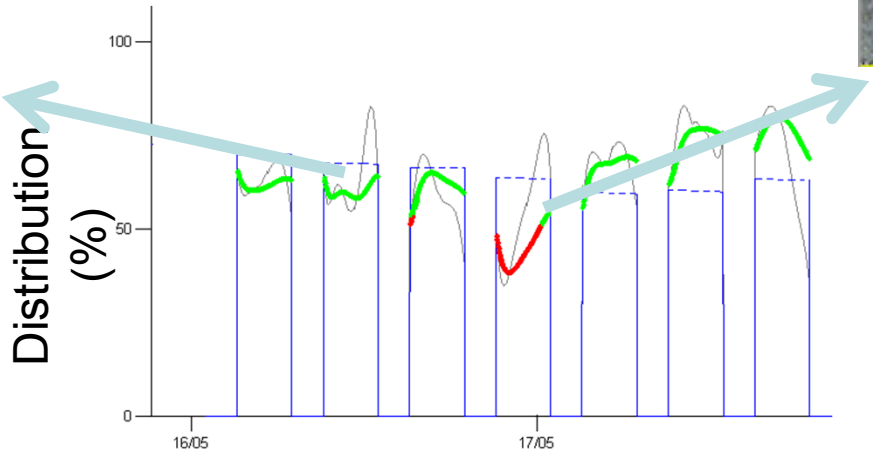
Event detection

Feeder line

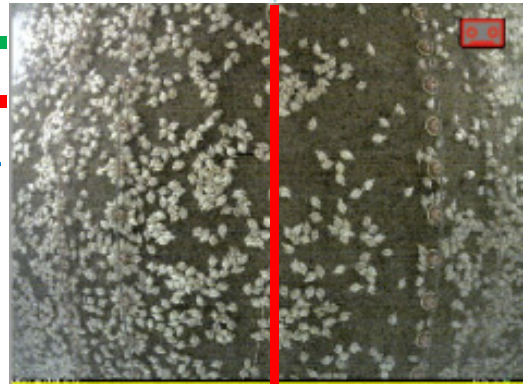


Normal situation

Measured values
Smoothed values within 25% range
Smoothed values out of 25% range
Predicted values

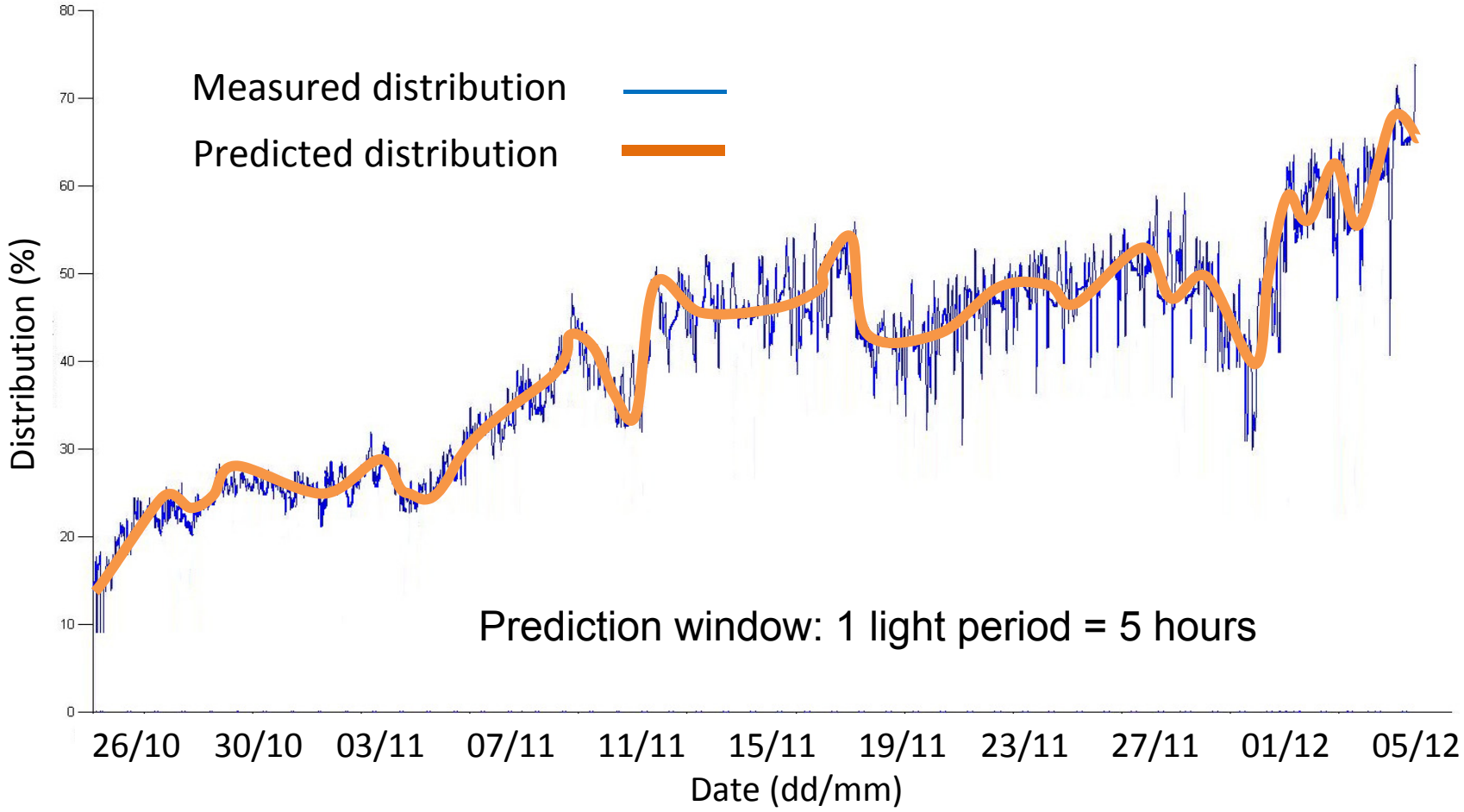


Defect Feeder line

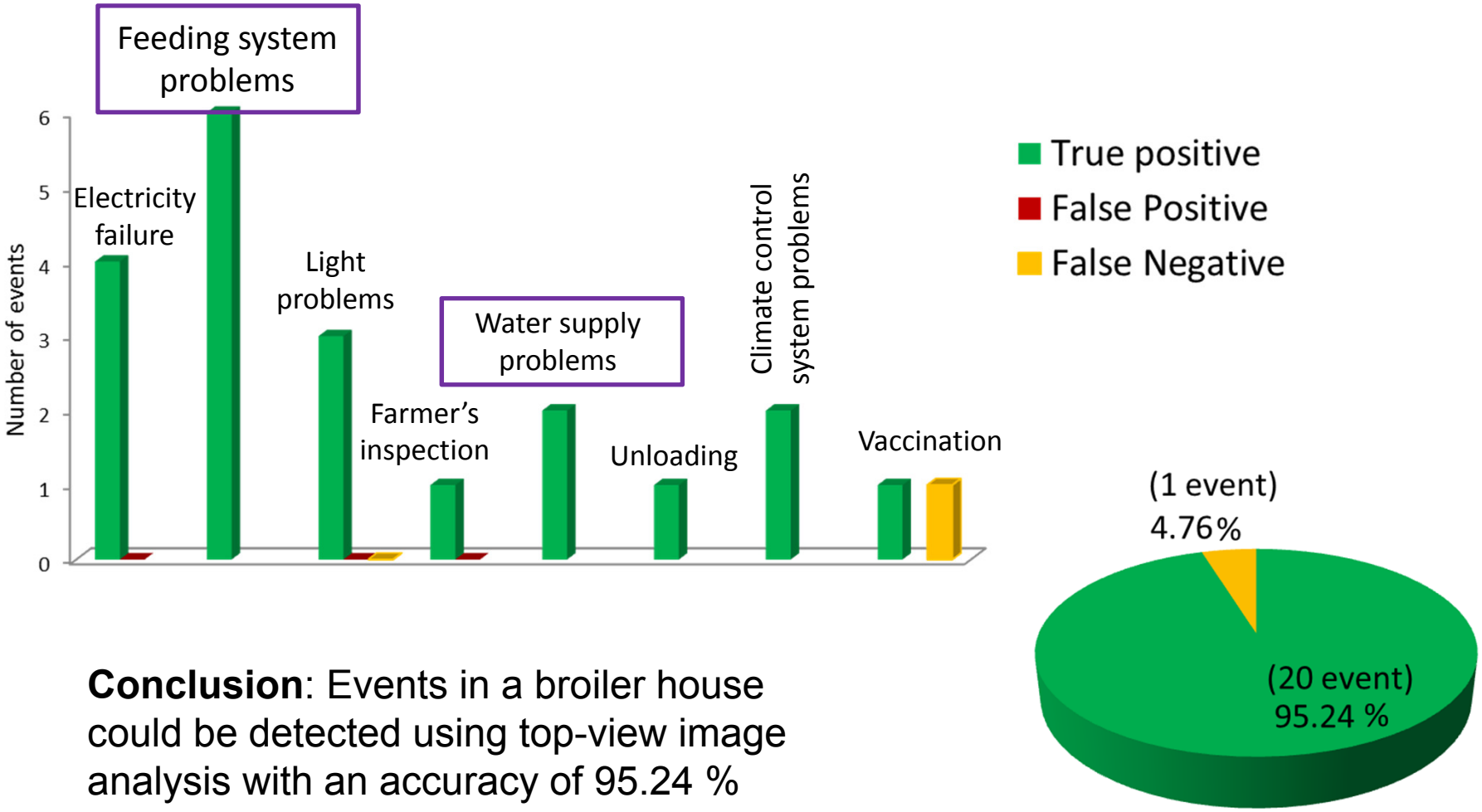


Problem in feeding lines

Measured vs. modelled animal distribution

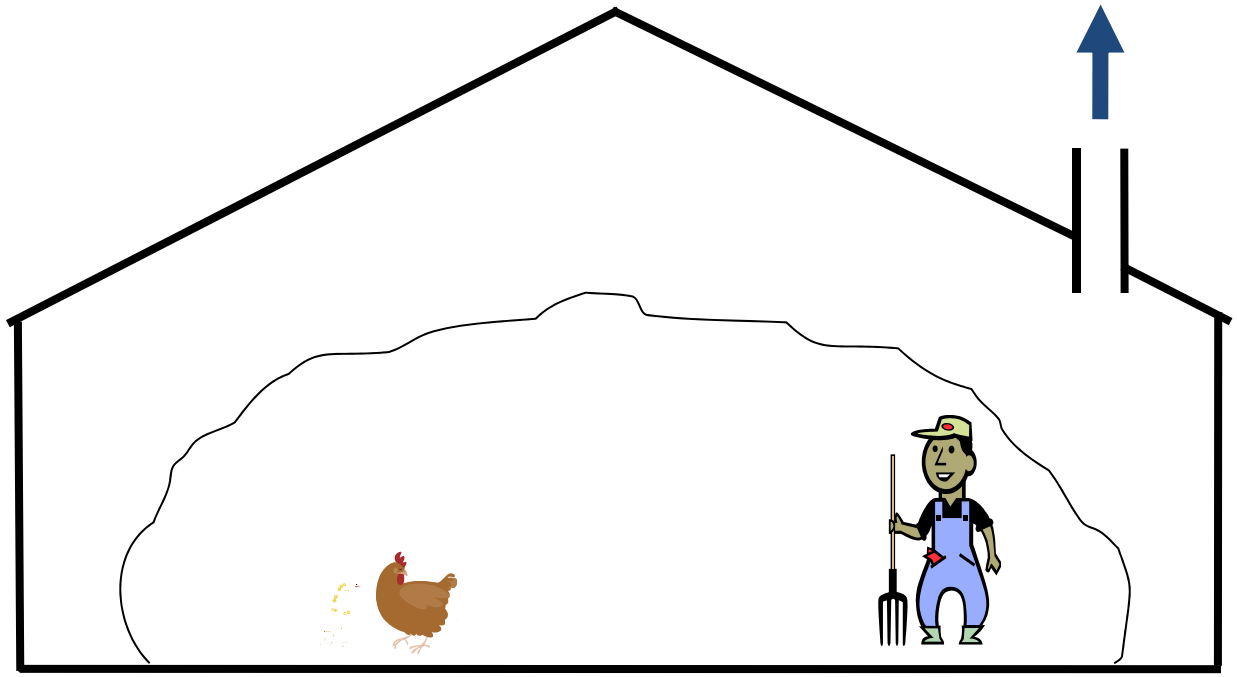


Detected events in the validation experiment over 42 days



Conclusion: Events in a broiler house could be detected using top-view image analysis with an accuracy of 95.24 %

Value:



Euros

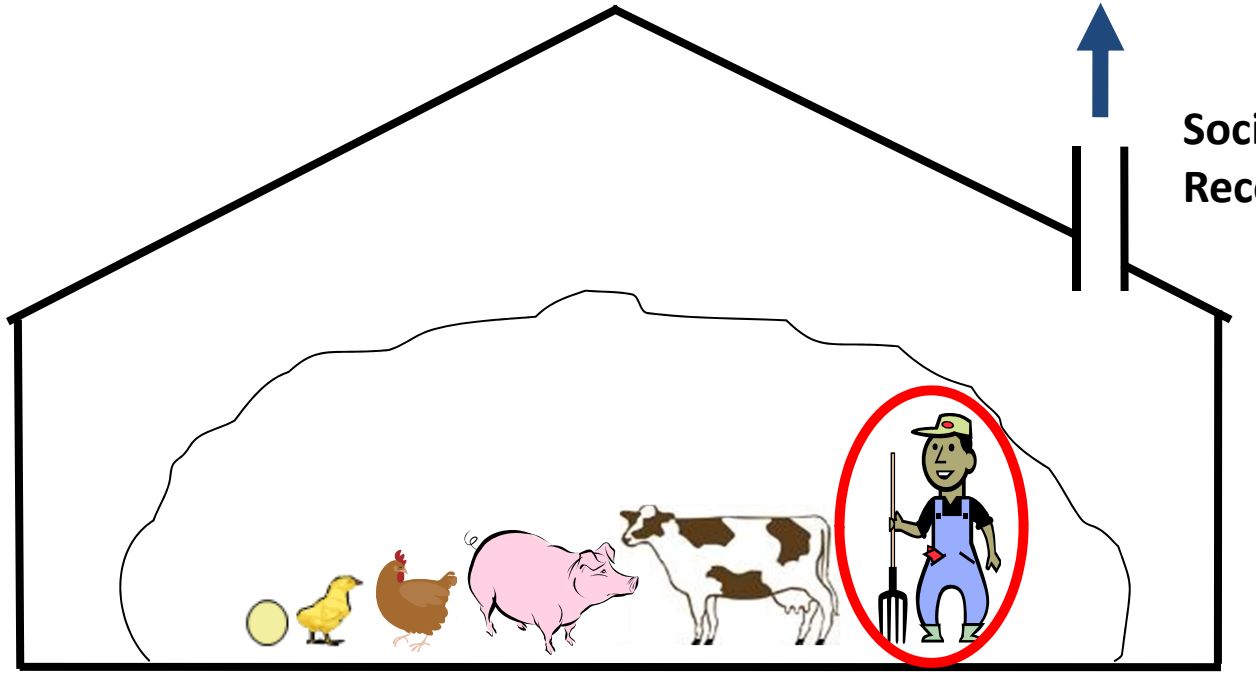
Labour and Time

Value: Summary

Value:

Environmental Impact

Social Recognition



Euros

Consumer

Welfare

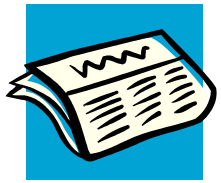
Health

Labour and Time

Value: For more Stakeholders

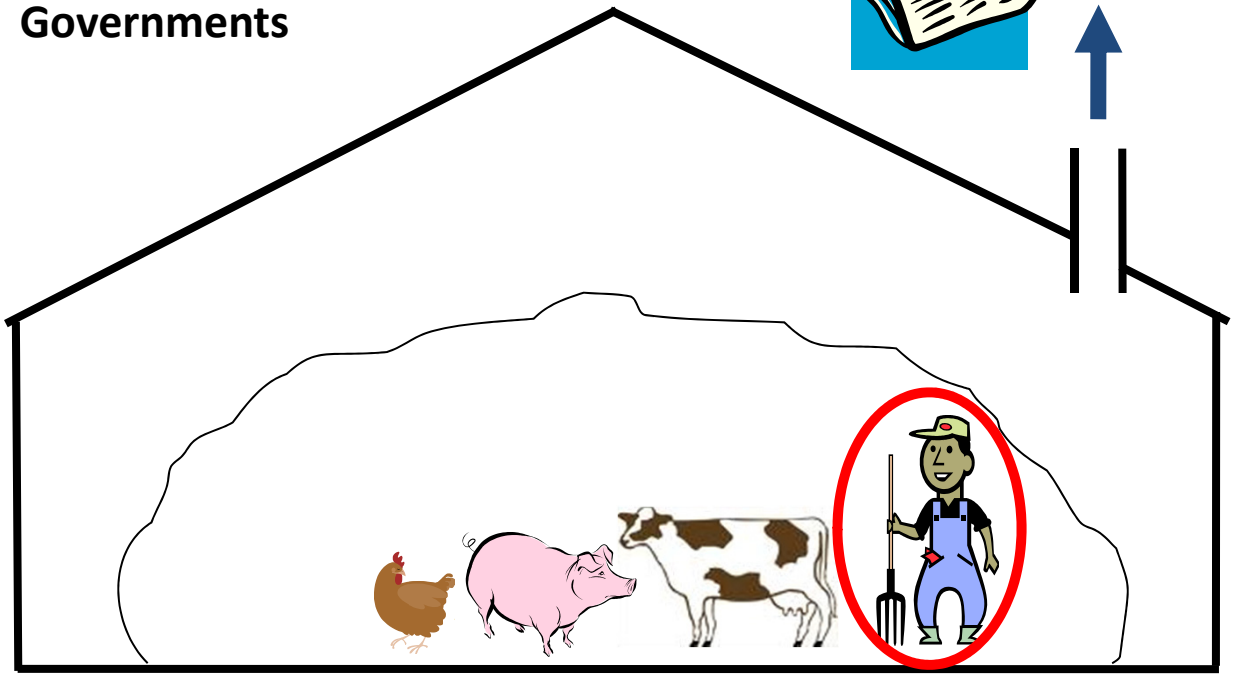
Governments

Press



Researchers

Citizens



Companies

Consumer

“Animal People”

Conclusions

- **Fully automated** and **continuous monitoring** (25 images/s, 20.000 sound samples/s, 24 h a day, 7 days a week) of animal variables is a reality
- PLF aims to offer a **management tool** that creates added value for the stakeholders, and meanwhile improves animal welfare, animal health, environmental impact, labour and time, euros (€), and social recognition
- **Value** must be created for different stakeholders
- If the farmer does not get value, the animal will not get it
- **Collaboration:** "animal people" & "PLF people"

7th European Conference on Precision Livestock Farming - ECPLF 2015, Milan - Italy

15 -18 September 2015

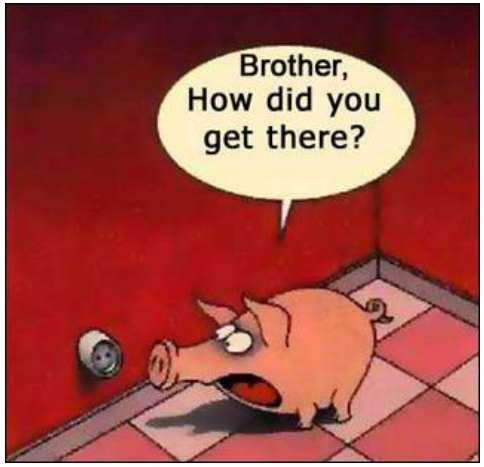
Organiser: Dr. Marcella Guarino

Thanks for your attention

For more information you can check our website:

http://www.m3-biores.be

Questions



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